"Show me the Data": A Recipe for Quality Improvement Success in an Academic Surgical Department

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Brief Title: Data-Driven Surgical Quality Improvement

ABSTRACT

Background

Surgeons in academic medical centers have traditionally taken a siloed approach to reducing postoperative complications. We initiated a project focusing on transparency and sharing of data in order to engage surgeons in collaborative quality improvement. Its key features were the development of a comprehensive Department Quality Dashboard and the creation of a Clinical Operations Council that oversaw quality. The purpose of this study was to assess the impact of those efforts.

Study Design

We compared inpatient outcomes before and after our intervention, allowing one quarter as the diffusion period. The outcomes analyzed were: risk-adjusted length of stay (LOS), mortality and direct cost and unadjusted incidence of complications and 30-day all-cause readmissions, as determined by the Vizient Clinical Database. We examined the outcomes of three groups: Group 1 (Surgery), Group 2 - all other surgical departments (Other Surgery) and Group 3 - all other patients (Non-Surgery). Two-tailed Students's t-test was used for analysis and a *p* value of <0.05 considered statistically significant.

Results

Group 1 demonstrated statistically significant improvements in mortality ($p=0.01$), LOS ($p=0.002$), cost ($p=0.0001$) and complications ($p=0.02$) while the all-cause readmission rate was unchanged, resulting in mean decrease of 0.55 LOS days and direct cost savings of $2300 per surgical admission. The comparison groups had only modest decreases in some of the analyzed outcomes and an increase in complication rates.

Conclusions

These data suggest that a collaborative, data-driven and transparent approach to assessing the quality of surgical care can yield significant improvements in patient outcomes.

Keywords: Quality Improvement, Outcomes, Surgery, Dashboard, Data Sharing

Introduction

In 2016, perioperative care accounted for an estimated 52% of acute inpatient spending. [1] Despite ongoing systematic efforts, such as the National Surgical Quality Improvement Program (NSQIP), administered through the American College of Surgeons (ACS), there remains significant debate regarding their efficacy. [2,3] The ACS has established recommendations regarding standardization of the surgical quality improvement process [4] but little information exists regarding the applicability and efficacy of these recommendations. Healthcare providers recognize the challenges of trying to improve patient care as the efforts are often arduous, results are slow to materialize, and the return on investment is not easily identified. Yet, the emphasis on healthcare quality has become even more critical as quality-driven reimbursement, patient demands, and efficiency are propelling a keenly competitive quality process.

The academic Department of Surgery at Indiana University School of Medicine is a large department comprising of six Divisions: General Surgery, Cardiothoracic Surgery, Transplant Surgery, Pediatric Surgery, Vascular Surgery and Plastic Surgery. It includes a total of about 125 faculty members, practicing throughout the School Campus in 7 facilities including the Richard L Roudebush Veterans Affairs Medical Center and 3 suburban hospitals . The flagship adult quaternary care hospital includes two facilities located within one mile from each other (University Hospital and Indiana University Health Methodist Hospital) collectively referred to as the Adult Academic Health Center (AAHC).

In late 2016, as a result of an “enterprise realignment” between Indiana University Health, the predominant healthcare system in the state of Indiana, and the Indiana University School of Medicine, responsibility for clinical operations, in addition to research and education, was incrementally shifted towards the Department Chairs. Within the Department of Surgery, a

reorganization effort was undertaken, with increased emphasis on quality of care and improvement of surgical outcomes.

The cornerstones of our quality reorganizations included the following : the establishment of a Council of Clinical Operations – led by the Chair of Surgery and including the newly appointed Chiefs of Surgery at each hospital, the newly recruited Department Chief Quality Officer, and a dedicated data manager; and creation of a quality dashboard that included essential quality elements of patient care and were populated from internal resources and risk-adjusted data from the Vizient database.[5] (Figures 1 and 2)

The Dashboard was adopted by the members of the Council which began monthly meetings in January, 2017. During the initial meetings, the dashboard was populated with historical data, when available, and was subsequently updated monthly. The data were disseminated to the Council members prior to the meeting for review and analysis. Selectively, data were also disseminated to divisions, sections or individual providers. The monthly Clinical Operations Council meetings included reports from each of the individual hospital Chiefs of Surgery, updates from the Chief of Quality on initiatives undertaken at the hospital or faculty practice plan level, and transparent discussions on dashboard trends and both positive and negative outliers. An important element of the Council's success was its transparency and the ability of the members to share information across hospitals. Figures 1 and 2 depict a sample of the dashboard for two different hospitals, reflecting the differences in issues that were realized based on the local environment of each hospital.

The purpose of this study was to assess the impact of these reorganizational efforts (dashboard and Council) before and after their implementation and to compare these results to quality data from non-surgical patients in the same hospitals.

Methods

From January 2017 through June 2018, quality data were collected and analyzed monthly. The focus of this study was on the Adult Academic Health Center only, as this is the largest hospital with the greatest number of admissions from all adult specialties

Allowing a diffusion period of three months for maturation of the new initiative, we decided to study the collective surgical outcomes in the period prior to the initiation of our effort and compare with subsequent results. We queried the Vizient Database for outcomes. Some items present on the dashboard had no historical data in the comparison groups and therefore were not included in this analysis - specifically, operational data such as patient access, operating room turnover, patient satisfaction etc. Risk-adjustment based on the Vizient risk models for mortality, length of stay and direct cost, depicted as an index value (or observed -to-expected ratio) were used. Complications were determined based on the Vizient database, and included medical and postoperative complications[5]. All-cause 30-day readmission rates were used.

In order to account for any effects by institution-wide efforts that may have been occurring simultaneously, outcomes of the entire institution were analyzed and compared for three groups: Group 1, included Surgery faculty members as Admitting, Discharging or Principal Procedure Physician (“Surgery”); in Group 2 those roles were assigned to another surgical faculty member (i.e. Orthopedic Surgery, Urology etc. – “Other Surgery”) and finally, Group 3 included the remainder of the academic health center population (“Non-Surgery””). Outcomes were analyzed by Discharge quarter, creating two time periods: Before (Q1-Q4 2016) and After (Q2 2017 to Q2 2018) the intervention. Mean values were calculated for each period and compared using

Student's t-test. A "*p*" value of <0.05 considered statistically significant. Microsoft Excel ™was used for the analysis.

Results

Table 1 summarizes the results. In all groups there was a small increase over time in the total number of patients treated. Group 1 (Surgery) showed statistically significant improvement in all measured outcomes, except for readmission rates which remained stable. Specifically, there were relative decreases by 6.6% in risk-adjusted length of stay (p=0.002), 19.4% in risk-adjusted mortality (p=0.01), 11.8% in risk-adjusted direct cost (p=0.0001) and 9.4% in complication rates (p=0.02). As a result, there were estimated decreases on 0.55 days and $2300 per admission in Group 1. Contrary to that, Group 2 (Other Surgery) experienced a modest relative improvement in LOS (5.3%, p=0.01) but with a corresponding relative increase in readmission rates (17.5%, p=0.04). Finally, Group3 (Non-Surgery) demonstrated improvement in risk-adjusted direct cost (4.8%, P=0.008), but had no significant changes in any of the other fields.

Discussion

Since the Institute of Medicine seminal report "To Err is Human" two decades ago[6], the impact of medical errors and adverse safety events associated with healthcare has come to the forefront. Multiple initiatives by virtually all healthcare organizations, new entities dedicated to healthcare improvement and exponentially growing literature on the subject all underscore the increasing importance of eliminating unnecessary patient harm. Surgical specialties have a particularly prominent role in that journey, as the operating room is a complex workspace with substantial potential for errors, with adverse event occurring in approximately 14% of surgical

encounters[7]. Despite considerable progress made, healthcare delivery is still far from the ideal concept of “zero preventable harm”, with significant variability between and within different organizations[8].

There are several barriers in the quality improvement journey in surgery. Arguably two of the most impactful ones are the lack of a “burning platform” and the lack of a standardized way of measuring quality and documenting improvement. With respect to the former, despite the increasing regulatory requirements and the constant discussion about quality and patient safety, there exists a well-established cognitive bias known as illusory superiority [9,10] whereby we tend to overestimate our abilities and achievements. This is superimposed to a strong effect of the availability heuristic[11] – in which surgeons tend to focus on most recent outcomes and quickly forget about previous, especially adverse, ones.

With respect to the latter barrier, several organizations have created large clinical databases tracking surgical outcomes. Some of the most prominent examples are the NSQIP and the Society of Thoracic Surgeons Database[12]. The strengths of those clinical databases have been documented in the past[2] and are without a doubt one of the strongest tools at out disposal with respect to QI in surgery. They are not without their downsides, however; the resources required for participation can be steep (administrative fees and cost for data managers), the scope of data limited (as database participation is voluntary and only a few procedures are tracked) and the lag time between cases and feedback to the providers significant. One way to mitigate some of these pitfalls is to use administrative or claims-based databases: these are already utilized by the institutions for billing purposes, nearly all cases are captured, and feedback to the provider, while not real-time, is certainly more timely. Unfortunately, the lack of specific clinical data may not

allow for “deep-dives” or very specialized clinical questions. In addition, providers tend to not trust administrative data as much and push back when they are evaluated by such metrics[13,14]. Regardless of the type of data, doubts have been raised that mere participation in a database does not lead to improvement in surgical quality[3,15]. We believe that there is validity in these concerns and in our own institution have observed that participation in NSQIP had led to a only limited number of successful initiatives. While we do not believe that this speaks to inherently rudimentary value of the NSQIP or similar clinical databases, we suspect that the lack of a near real time reporting mechanism creates challenges in engaging surgeons and hinders the potential for creation of a change momentum.

Recognizing the need to improve the quality of surgical patient care across our healthcare system and the barriers associated with doing so, we implemented a unique approach that included the essential elements of quality improvement that were best matched for success within our healthcare system. These included the following: First, ensuring commitment of the department and institutional leadership in elevating quality of care to the true “North Star” for the department. Second, clear delineation of roles and accountability as reflected by the creation and financial support of several new part-time positions (mostly averaging 10% FTE), specifically relating to quality improvement and operational excellence. These included:

-appointing a Chief of Surgery for each institution served by our Department. It should be noted that this position was different than the “Surgeon-In-Chief” role that is present in some AHCs (but not in our facilities) in that it only related to the faculty belonging to the Department of Surgery.

-recruiting a Chief Quality Officer for the Department, who worked closely with the Chiefs in each hospital, the division and section Chiefs and the Department Chair in setting the

overarching course for quality improvement in the department, and also serve as a liaison between the department and other stakeholders (the parent healthcare organization and the faculty practice plan)

-recruiting a data analyst for the department, who was tasked with collecting the data and creating the departmental dashboard, and collaborating with all departmental stakeholders in identifying relevant trends and providing deeper dives into the data when needed.

The third element is the use of reliable and actionable data in order to evaluate progress in quality improvement. We chose to utilize a combination of measures in our dashboard, including process and outcomes ones. The differential value of these types of metrics has been previously discussed[16]. Process measures are generally straightforward to track and monitor and can help identify distinct actions required. Outcomes measures on the other hand are almost always multifactorial in etiology; may be more challenging to document accurately and, most importantly, are prone to significant confounding due to patient comorbidities, requiring risk adjustment.

As mentioned above, the easy access and uniform capture of all surgical patients in an administrative dataset presented significant appeal. Our institution participates in Vizient, Inc. (formerly UHC) and as such we have access to the Vizient, Inc. Clinical Database, which allows for risk-adjustment of our data based on well established risk models for certain outcomes (mortality, length of stay and direct cost). This also provided an additional significant advantage: leveraging the power of the Vizient database we were able to use appropriate filters and capture all patients served by our departmental faculty - and not rely solely on administrative definitions of “service lines” based on DRGs. We noticed that initial arguments by surgeons against the validity of the data presented to them subsided over time, as familiarity with the data increased.

Finally, the data provided by this database are much closer to “real-time” compared to other sources (such as NSQIP), which allowed out to construct a more agile and actionable dashboard. The final element required for success is complete transparency – in sharing both the data with the pertinent stakeholders, but also lessons learned “on the ground” by different institutional leaders that could prove useful in other settings. As demonstrated in Figures 1 and 2, the issues and priorities faced at the local level differed considerable from one institution to the next. However, the process for analyzing the problems, and solutions that may have been already implemented in the past were readily shared and allowed for faster and smoother implementation at all institutions. For example, readmission data were lower than expected for patients in the cardiothoracic division at Indiana University Health Methodist hospital. Further analysis showed that the cardiothoracic surgeons tracked 30-day readmissions and identified that patients with congestive heart failure and dysrhythmias had higher readmission rates. These high-risk patients were identified early in their hospitalization and were scheduled for more frequent clinic visits. Another example of how data were shared at the Clinical Operations Council included an issue related to clinic cycle time. The clinic at Indiana University Health Methodist hospital had only two rooms large enough to accommodate patients who were transported on stretchers. These patients had large, complex wounds that often required debridement and hence, more than twice the usual patient evaluation time. To improve clinic cycle time, these patients were evaluated in the wound care center instead, thus improving clinic cycle time. Finally, the same clinic kept an “open access” position on its schedule so to accommodate the unexpected request for a patient evaluation and therefore decrease the “new patient lag” time. Although these solutions may seem intuitive, the information shared among hospitals at the Clinical Operations Council generated discussion among its members and, in some cases even improved solutions

As expected with any quality improvement project, there are associated weaknesses. First, the three patient groups have different characteristics and are often in different environments, making direct and accurate comparisons suboptimal. This is a valid criticism of our study but nonetheless the quality trends identified over time seemed to validate that our efforts were making a difference. Also, unidentified confounding factors may be present and account for the extent of the effects, especially in a large and complex organization such as Indiana University Health, and since quality improvement efforts do not occur in a vacuum. Furthermore, it is possible that the observed improvements may be a reflection of the Hawthorne effect – observing improvement in the quality metrics just by the mere process of monitoring those metrics. Finally, it is possible that some changes in the risk-adjusted outcomes are a reflection of the changes in the risk model calculations over time. However, we believe that these would likely be uniform across the entries population and not limited to the patients treated by our Department. Nonetheless, the strengths of our study, large patient volume and the diverse comparisons add value to the described quality improvement process. The Clinical Operations Council will continue in its quest for improved patient care and we anticipate reporting more data over a longer period of time in hope that this process shows sustainability.

Conclusion

These data suggest that a collaborative, data-driven and transparent approach to assessing the quality of surgery patients can yield significant improvements in patient outcomes.

Recommendations

Based on our study, we offer the following suggestions for the leadership at other academic health centers to consider as they pursue their quest for improved surgical patient care:

1. Invest in a system that is in alignment with broader institutional quality goals. This includes the investment of time and funds to ensure that quality is a top priority in the department.
2. Promote surgeon engagement across all specialties, realizing the uniqueness of the challenges that they encounter.
3. Ensure transparency and encourage sharing of best practices.
4. Have realistic expectations as some issues are very complex and may require multipronged solutions.
5. Keep the big picture in mind yet realize that it is necessary to understand the clinical picture and to drill down on the data to discover the best solution.

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Table 1: Comparative Outcomes of the Different Study Groups

Mean values	Before (Q1/16 – Q4/16)	After (Q2/17 – Q2/18)	Relative change, %	p Value
Group 1, surgery, n	8,988	9,602		
LOS index	1.11	1.04	–6.6	0.002*
Mortality index	1.17	0.94	–19.4	0.01*
Direct cost index	0.99	0.87	–11.8	0.0001*
Complication rates, %	7.9	7.1	–9.4	0.02*
Readmission rates, %	13.2	13.2	0	0.99
Group 2, other surgery, n	9,590	10,450		
LOS index	1.06	1.00	–5.3	0.01*
Mortality index	1.09	1.00	–8.2	0.55
Direct cost index	0.95	0.96	+0.1	0.95
Complication rates, %	5.3	6.4	+19.4	0.12
Readmission rates, %	7.5	8.8	+17.5	0.04*
Group 3, non-surgery	20,998	24,952		
LOS index	1.04	1.01	–2.9	0.08
Mortality index	1.07	1.02	–4.2	0.38
Direct cost index	0.96	0.92	–4.8	0.008*
Complication rates, %	3.5	3.8	+6.5	0.2
Readmission rates, %	13.7	13.8	+0.8	0.79

*Significant.
LOS, length of stay; Q, quarter.

Figure 1: Surgical Quality Dashboard Sample for Indiana University Hospital (values removed).

Figure 2: Surgical Quality Dashboard Sample for Indiana University Health Methodist Hospital (values removed).

Precis

A data-driven, collaborative approach at an academic department of surgery, based on transparent sharing of actionable data and defined accountability structure, led to significant improvement in patient outcomes.

University	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Resource
ALOS														Vizient
LOS Index														Vizient
Clinic Cycle Time- IUSCC														Tableau
Clinic Cycle Time- SOPA														Tableau
Direct Cost Index														Vizient
Handwashing														Tableau
Harms Events														Vizient
Mortalities														Vizient
Mortality Index														Vizient
New Patient Lag														Tableau
Patient Satisfaction- Inpatient														-
Patient Satisfaction- Outpatient														NRC Picker
Readmission Rate														Vizient
Total Cases														Vizient
Turnover (Goal < 30 Minutes)														Tableau
Discharges Before Noon														Resource
3 South														EDW
ALOS														EDW
Total LOS														EDW
3 North														EDW
ALOS														EDW
Total LOS														EDW
5 South														EDW
ALOS														EDW
Total LOS														EDW
5 North														EDW
ALOS														EDW
Total LOS														EDW

Methodist	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Resource
ALOS														Vizient
LOS Index														Vizient
Clinic Cycle Time														Tableau
Direct Cost Index														Vizient
Handwashing														Tableau
Harms Events														Vizient
Mortalities														Vizient
Mortality Index														Vizient
New Patient Lag														Tableau
Patient Satisfaction- Inpatient														-
Patient Satisfaction- Outpatient														NRC Picker
Readmission Rate < 30 Days														Vizient
Total Cases														Vizient
Turnover (Goal < 30 Minutes)														Tableau
Discharges Before Noon														Resource
4 North														EDW
ALOS														EDW
Total LOS														EDW
5 South														EDW
ALOS														EDW
Total LOS														EDW
6 South														EDW
ALOS														EDW
Total LOS														EDW
5 NCC														EDW
ALOS														EDW
Total LOS														EDW